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Winter  
2020

# EAERE Magazine



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**EAERE**

European Association  
of Environmental and  
Resource Economists

EAERE Magazine serves as an outlet for new research, projects, and other professional news, featuring articles that can contribute to recent policy discussions and developments in the field of environmental and natural resource economics. It is published quarterly in the Winter, Spring, Summer, and Fall. Contributions from the wider EAERE community, especially senior level researchers and practitioners, and EAERE Country Representatives, are included in the magazine.

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**Astrid Dannenberg** is Professor of Environmental and Behavioral Economics at the University of Kassel and Editor of the EAERE Magazine.

Dear EAERE friends and colleagues,

Happy New Year! I hope you all had a good start into 2020. This year is special for EAERE because we celebrate its **30<sup>th</sup> Anniversary**. For this reason, the Magazine this year will not only present recent research but also reflect on the history of the Association, how it began, where we are now, and what possibly needs to change in the future.

We start with a contribution by the new President, **Christian Gollier**, Toulouse School of Economics, who writes about recent initiatives of EAERE that represent a break with previous traditions and may show the way forward.

Who could tell us better about the beginning of EAERE than the first presidents? Monica and I got in touch with the first two Presidents, **Henk Folmer** and **Rüdiger Pethig**, and fortunately they both agreed to write about how it all began. Reading their reports gives a sense of the vision, diligence, and persistence that they and the other involved people had at a time when environmental economics was not a field of research yet (my feeling is, though, that they both understated their efforts).

Following them, we have two articles on recent research projects. **Ricardo Daziano**, Cornell University, **Briana Amoroso**, Taitem Engineering, and **Charleen Heidt**, NYSEG, present a genuinely interdisciplinary research project where researchers work together with the electricity and gas provider of upstate New York to optimize the integration of electric vehicles with the energy grid to reduce peak demand problems. Then a team of psychologists, **Helen Fischer**, Stockholm Resilience Center, **Dorothee Amelung** and **Nadia Said**, both from the University of Heidelberg, present recent findings on people's confidence in their own climate change knowledge.

This time we do not end with a Juniors-ask-Senior interview as usual, but with a memorial about a true star in environmental economics, written by **Gernot Wagner** about **Martin Weitzman**.

I hope you enjoy reading this issue as much as I did.

Astrid Dannenberg

# Climate economics: From theory to policy

**Christian Gollier**

President of EAERE, Toulouse School of Economics, France



**Christian Gollier** is an internationally renowned researcher in Decision Theory under Uncertainty and its applications in climate economics, finance, and cost-benefit analysis, with a special interest for long term (sustainable) effects. He is fellow of the Econometric Society, and he received an ERC Advanced Grant. With Jean Tirole, he created the Toulouse School of Economics, where he served as Director (2007-2015) and Vice-President (2017-). He is the President of the European Association of Environmental and Resource Economists. He is one of the Lead Authors of the last two reports of the IPCC.

*For 30 years, EAERE's unwritten rule has been that it takes no side on any policy issue. This rule has been broken in the summer of 2019 by the publication of the "Economists' Statement on Carbon Pricing". The full internal support to this statement is an important event in the life of our institution. At this critical period of Humanity in which ecological and economic issues compete for being the collective priority in the public debate, this new goal for EAERE is welcomed.*

Our house is on fire. For a long time, people looked elsewhere. Some even denied the existence of the fire, while others claimed that the smoke seen above the house was not due to a fire. As the flames now rise high above the roof, experts are still debating about the best strategy to fight it. It is right that the complexity of this fire has never been seen before, and that the coordination problem of the billions of firefighters (and arsonists) is particularly delicate. The inhabitants of the house, from Greta to Naomi, now get extremely frustrated by the delays in the reaction. They are expressing their frustration to the policymakers and their advisors. Some are ready to rely on new radical prophets to solve the problem. It is time for the experts to provide a clear and efficient plan to extinguish this fire before it becomes really too late.

Climate change is the biggest market failure faced by Humanity. The global externality engendered by the emission of greenhouse gases is a tragedy. This tragedy is spatial because the sacrifices incurred by one country to abate its emissions will mostly not benefit to that country, but to all other countries. Why would France do anything since it contributes to less than 1% of global emissions? And the story

goes on with deeper granularity of the question, moving to regions, cities, small corporations and individuals. The tragedy is also temporal because of the inertia of the climate system. The duration of the flow of climate damages generated by the CO<sub>2</sub> emitted today is approximately 80 years. The sacrifices accepted by the current generation will mostly not benefit to us, but to all future generations. This two-dimensional tragedy yields only one outcome, the completely inefficient equilibrium of the prisoners' dilemma, with no one doing anything to fight climate change. Our house is burning. We are probably fully aware of the problem since the early 90's, but the total emission of CO<sub>2</sub> increased from 23 GtCO<sub>2</sub> in 1990 to 36 GtCO<sub>2</sub> today.

The inconvenient truth is that the greenhouse effect is a catastrophe for our prosperity because it forces us to replace the easy-to-use and cheap fossil sources of energy by renewable sources that are much more expensive to produce, at least for a foreseeable future. The degrowth movement and the proponents of a green dictatorship propose to solve the problem by killing prosperity. Capitalism is often claimed to be responsible for the problem. The corollary of this claim is that the best strategy to fight climate change is to destroy capitalism. It is probably true that a regulated free-market economy offers the best mechanism to satisfy the aspirations of the consumers. So, who is guilty? The mechanism at the source of our prosperity or the people who benefit from it? Too many politicians are now surfing on the utopia of a happy energy transition which would yield millions of beautiful jobs and a re-

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duction of the energy bill. The side effect of this political discourse is that most citizens get frustrated with the absence of political reaction to climate change, but at the same time strongly oppose any policy that would transparently require them to make sacrifices to their well-being.

European governments and the European Union have not been inactive on the climate front. Ambitious emission norms have been enacted in the residential and transportation sectors. Incandescent bulbs have been eliminated. Very generous feed-in-tariffs for PV panels and windmills have been installed to boost these renewable sources of energy. Bonus-malus systems in the automobile markets have incentivized consumers to purchase greener cars. Most of these climate micro-policies are vastly inefficient. They all face the “rebound effect”. They also often cost much more than the anticipated benefit, many policies costing more than 1000€ per ton of CO<sub>2</sub> saved. The good thing is that these costs are often hidden, so that the political acceptability constraint is not a problem. Finally, these solutions are too narrow to efficiently contribute to the global solution. At the same time, coal could be replaced by natural gas which emits much less CO<sub>2</sub> per kWh produced. This would not cost more than 40 €/tCO<sub>2</sub>, but this obvious policy is not implemented. Germany has promised to exit from coal not later than 2038, and Poland continues to use coal to produce 80% of its electricity!

Do economists have a science-based doctrine on this matter? In the face of this global failure to confront climate change over the last 30 years, the surprising answer to this question is a big “yes”. In the summer of 2019, the European Association of Environmental and Resource Economists published an “Economists’ Statement on Carbon Pricing”.<sup>1</sup> It has been the first time that the EAERE took an institutional position in the public debate. To my own surprise, I am not aware of any negative reaction, external or internal, to this break in our institution’s unwritten rule of policy neutrality. This echoes the initiative of the American-based Climate Leadership Council which published its own economists’ statement<sup>2</sup> in the Wall

Street Journal on January 16, 2019. The EAERE statement is a European adaptation of this “Plan A”. It consists in implementing Arthur Pigou’s original idea<sup>3</sup> of 1920 by correcting the mispricing of the climate externality through carbon pricing. By imposing the same price to any molecule of CO<sub>2</sub> emitted on Earth that equals the marginal climate damage generated by this molecule, one realigns the myriad of private interests with the common good. Moreover, the universal price of carbon, with no exemption or reduced price, allocates the effort in a way that minimizes the global sacrifice for any given climate objective. All economists know that, and many teach this great policy recommendation in their ECON-101 course. The universal carbon price, growing over time, efficiently coordinates a degrowth movement, but only to the detriment of carbon-intensive goods and services.

This consensus among economists is in striking contrast with the existing political chaos in this domain. It is right to say that economists have not been very efficient to promote their ideas in the past. They fought a lot about the choice of instruments (tax vs. permits), or about the level of the carbon price. They pinpointed complex obstacles, such as carbon leakages, the free-riding problem in international negotiations, the impact of carbon pricing on inequalities, and the long-term credibility of the policy. The leakage and free-riding problem can be solved by imposing carbon-linked border taxes, as claimed by the U.S. and EAERE’s statements. The inequality problem can be solved by the cleverly allocating part of the “carbon dividend” to the poorer deciles of the population. The long-term credibility issue can be solved by creating an independent “Carbon Central Bank” which would get the democratically-based mandate to reduce emission at a speed pre-defined by the citizens.

EAERE and its recently created Policy Outreach Committee will be active in communicating on these issues in the coming months during which the new von Der Leyen Commission will shape its “Green Deal”. Given what is at stakes, from the destiny of Humanity on Earth to the jobs of Polish miners and the purchasing power

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of the French yellow vests, it is likely that this Green Deal policy will not follow our preferred Plan A. Consequently, it is crucially important for economists around the world to continue to explore different Plan B, from green finance to the myriad of alternative climate micro-policies and strategies.

#### **Endnotes**

<sup>1</sup> [www.eaere.org/statement](http://www.eaere.org/statement)

<sup>2</sup> <https://clcouncil.org/economists-statement/>

<sup>3</sup> Pigou, A., *The Economics of Welfare*, Macmillan, 1920.



# The rapid coming of age of EAERE<sup>1</sup>

**Henk Folmer**

*University of Groningen, The Netherlands*



**Henk Folmer** is professor of regional economics at the University of Groningen, The Netherlands and of general and environmental economics and econometrics at the North West Agricultural and Forestry University, Yangling, China. He is editor of *The International Review of Environmental and Resource Economics* and *Letters in Spatial and Resource Sciences*. He serves on the editorial board of various journals on environmental and regional economics including *Environmental and Resource Economics*, *The Annals of Regional Science* and *The Journal of Regional Science*. He has supervised 40 PhD students from developed but especially from developing countries. He holds an honorary doctorate from the University of Gothenburg, is fellow of EAERE and the Regional Science Association International, Renowned Overseas Scholar, China Ministry of Education and Outstanding Foreign Expert, Shaanxi Province, China.

## The prehistory

EAERE had an unexpected, unintended and somewhat messy start. The association's very beginning dates back to 1987 when I, as a newly appointed professor of general economics at the University of Wageningen, The Netherlands, was asked by the rector to also "pay attention to environmental and resource problems". I was not really familiar with the topic but had become interested at a regional science meeting at the University of Umea, Sweden, where I had run into Karl-Gustaf Löfgren, Karl-Göran Mäler and Horst Siebert who showed great enthusiasm about environmental and resource economics. I was impressed by their presentations and picked up some basic concepts and theories. To follow up on the rector's request, I decided to familiarize myself with the field by organizing a conference in Wageningen rather than studying textbooks and papers. From the program of the Umea conference, I picked up topics and, especially, names of people who had given presentations for large audiences. To my surprise, virtually all of the addressees were interested in coming to Wageningen. Moreover, they provided me with names of other potential participants. The conference was a great success and I learned a lot. At one of the dinners with keynote speakers, I asked around if it might be useful to have something like a "European Association of Environmental and Resource Economists". The answers to my question were unanimously positive but I had to pay a price: the dinner guests told me that it was me to get the association started. As a sticking plaster, they appointed me president. The first things for me to do were to form

a provisional board, to recruit members, to get some financial support and to organize the next conference. These tasks were not too complicated. Horst Siebert, Karl-Göran Mäler and David Pearce were happy to join the provisional board. Recruiting members was also quite easy. Virtually all the participants of the Wageningen Conference and the environmental economists of the Umea Conference signed up. In addition, the word about the new association spread quickly around in Europe and the USA and within no time there were more than a hundred members. Another stimulus to join EAERE was the launch by Kluwer Publishers, now Springer, of a new journal, *Environmental and Resource Economics*. The journal was run in close cooperation with the association's provisional board and was made available to EAERE members at a reduced price. The organization of the next meeting was facilitated by the fact that I served on the EU Task Force on the Environment and the Single European Market where I used to meet Frank Convery who was well connected with many officials of the European Commission, especially Jos Delbeke at the Directorate-General for the Environment. Jos was willing to support the next conference financially. Frank's extensive network also included people at the Fondazione Enrico Mattei who were interested in hosting the next meeting in Venice. The conference, with Ignazio Musu in charge of the local organization, was a great success in every possible respect: scientifically, socially, culturally and gastronomically. In addition, it was very relaxed because the presentations

were at times interrupted by waves breaking on the windows of meeting rooms.

From the Venice meeting onwards, EAERE gained momentum and applications for membership from all over the world poured in such that the membership more than doubled within a year. At the Venice meeting, representatives from the Stockholm School of Economics volunteered to organize the next conference which also became a great success in every respect. At this meeting, a nominating committee for the first official council was installed and the first election was organized. I was lucky enough to be elected as EAERE's first official president with Karl-Göran Mäler, Juan Martinez-Alier, Ignazio Musu, Rüdiger Pethig and Domenico Siniscalco as council members. One of the first tasks of the new council was to draft bylaws which I did together with Rüdiger Pethig. The bylaws have stood the test of time which shows that Rüdiger is not only an excellent economist but could also have made a fortune as a lawyer. In subsequent years the addition of a newsletter, summer and winter schools and various kinds of awards completed the establishment of EAERE as a full-blown scientific organization.

### **EAERE's external links**

Another major development was EAERE's establishment of relationships with similar associations in other parts of the world. From the Wageningen meeting onwards, EAERE conferences were attended by many members of the Association of Environmental and Resource Economists (AERE), the North American sister association. The close cooperation between EAERE and AERE led inter alia to the institutionalisation of the four-annual World Conference of Environmental and Resource Economists, the first one in Venice in 1998. The cooperation between EAERE and AERE set in motion a mission to found similar associations at other (sub) contents so that in the not too remote future there will be a global network of environmental and resource economists.

Right from the start, EAERE was well-connected with policy-makers. From

the Venice meeting onwards, EAERE conferences were attended by representatives of the European Commission, particularly Jos Delbeke, who rightly was the first to receive the EAERE Practitioner Award for his relentless support for EAERE and the promotion in the policy arena of views and insights, notably on policy goals and policy instruments, developed within the association. But also many representatives of national and local governments started interacting with EAERE members and attending the annual EAERE conferences. The interaction was beneficial to both sides. Policymakers were injected with the latest scientific insights and, vice versa, the real world problems of policymakers formed inputs to theoretical and empirical research.

### **Adulthood**

In the good old days, the main themes of the EAERE conferences and also of *Environmental and Resource Economics* were theory, policy instruments and valuation. The debate about the policy instruments concentrated on design principles and the pros and cons of economic instruments versus command and control. The main valuation topics were the need for valuation, amongst others as input into cost-benefit analysis, and valuation methods. Shortly after the establishment of EAERE the scope was widened to encompass virtually all possible themes of environmental and resource economics.

Although it is presumptuous and inappropriate to criticize a highly successful jubilarian, I cannot resist the temptation to suggest that it might be beneficial to EAERE and environmental economics to widen the scope by also looking at the developments in the sister social sciences, notably psychology, sociology and political science. Economists, but also non-economists, tend to see economics as the Queen of the social sciences (Fourcade et al., 2015) because of its powerful analytical (mathematical) tools (Freeman, 1999) which par excellence lend themselves to applications in the neo-classical framework of utility or profit maximization. These fortunate circumstances have led to bias towards the neoclassical paradigm as analytical framework and hampered the

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interest in the less rigorous paradigms of the sister social sciences, in spite of the fact that several of the greatest minds in economics (including the distinguished mathematician and economist Morishima!) have criticized it for more than a century and recommended integrating economics and the sister social sciences.

The preoccupation with the neoclassical paradigm naturally applies to environmental and resource economics which very much is a theory of externalities and market failure applied to the environment. This means that the criticism to the neoclassical paradigm in general also translates to environmental and resource economics (see amongst others Folmer and Johansson-Stenmann, 2012). This is unfortunate. Although the neoclassical paradigm may produce valuable insights as first working hypotheses, they need testing and supplementing with inputs from alternative paradigms, notably behavioural and new institutional economics (which is increasingly happening) and, more generally, from the sister social sciences (which is happening to a much lesser extent) so as to obtain a fuller understanding of the complexities of environmental and resource problems and policy. In my view, too much work in the neoclassical arena does not cross the borders of its safe heaven which hampers the developments neoclassical economics, the sister social sciences and policymaking and, not in the least, the credibility of the field.

Especially empirical research may benefit from validation and measurement of abstract theoretical (neoclassical) concepts and systematically including covariates from the sister social sciences since this reduces the risk of mis-specified models, biased estimators of the coefficients of (economic) variables, and biased tests (Greene, 2018). Moreover, including systematic covariates from the sister social sciences is likely to offer a fuller understanding of how and why agents act as they do. After all, responses to environmental problems and policy are not only guided by economic incentives like prices but also by typical sociopsychological variables like experience, awareness and perception (see amongst

others, Tang et al., 2013) and motivational drivers like norms (Steg et al., 2015).

#### Endnote

<sup>1</sup> I thank Frank Convery for his valuable comments!

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# There is magic in every beginning<sup>1</sup>

**Rüdiger Pethig**

*University of Siegen, Germany*



**Rüdiger Pethig** graduated in Economics (Volkswirtschaftslehre) at the University of Münster, Germany. He received his Ph.D. (1973) and Habilitation (1977) in Economics from the University of Mannheim, Germany. During 1979 – 1988, he was Professor of Economics and Public Finance at the University of Oldenburg, and during 1988 – 2009 he was Professor of Economics and Public Finance at the University of Siegen. After retirement in 2009, he is still active in research and works, in particular, on research projects financially supported by the German Research Society (DFG). He is a founding member and an honorary member of EAERE, an EAERE fellow, and he was the president of EAERE during 1994 – 1995.

## A personal view on the pre-EAERE era

The launch of EAERE made a great difference (for the better !) in the development of the field of environmental and resource economics (ERE) in Europe and beyond. To appreciate that difference, let me briefly sketch how I perceived the pre-EAERE time. As a student of economics in the second half of the 1960s, I was aware, like many people, of regional water or air pollution that began making their way into the headlines of the media. But we believed fixing pollution is more like cleaning a dirty kitchen floor than an issue for academic economics. We knew about Pigovian externalities and taxes and the Coase controversy, but we associated Pigou with bees and orchards and Coase with ranchers and farmers without fences – which did not seem to be a rewarding field of work for young economists. However, when I was a Ph.D. student in the early 1970s, Horst Siebert raised my understanding for the relevance of, and my interest in, ERE. The seminal paper on “Production, Consumption and Externalities” (Ayres and Kneese, 1969) convinced me that environmental externalities are pervasive rather than exceptional. The metaphor of the spaceship earth (Boulding, 1966) draws the attention on the twin issues of pollution and natural resource use and was an eye-opener, jointly with the later “Limits to Growth” (Meadows et al. 1972), for the unsustainability of unregulated pollution and natural resource use.

In the 1970s, Europe lagged behind the US based research in the new field of ERE. The *Journal of Environmental Economics and Management* was the first major field journal (1974), and the Asso-

ciation of Environmental and Resource Economists (AERE) was founded five years later in the US. Although a growing number of European economists began doing serious research work, many citizens and mainstream economists used to perceive ERE as a niche for a few strange – and perhaps ill-guided? – economists. The German environmental grass-root movement of the ‘Greens’ (that became a party as early as 1980), was dominated by fundamentalist views that considered not only economics but also ERE as part of the problem rather than part of the solution.

It is necessary to recall that throughout the 70s and 80s the transaction costs of disseminating research work and of communicating and networking were much higher than they are now, which is not only true for ERE, of course. In the (almost) pre-digital era the dissemination of new work was much more incomplete and slower than now. In Europe, cultural and language barriers were much higher than e.g. in the US, since the English language was used less as an academic lingua franca than now, and the international community hardly took note of research contributions in languages other than English. In short, what was badly missing was an annual forum in a common language where new ideas and findings are presented and discussed, and where people working in the field realize that they are part of ‘physical’ community and not only printed names. There is another difference between the pre- and post-EAERE times that is worth mentioning (and that also relates to economics at large). The more systematic use of the English language was accompanied by a more systematic shift to the use of eco-

conomic journals as an outlet. In the 70s and 80s ERE research was published in conference volumes much more often than today. I attended quite a few such conferences with about 30 to 40 participants. Such meetings were extremely stimulating and enjoyable, but the downside was that chapters of such volumes were not – and often are not yet – easily accessible. Publishing in high-ranking journals was desirable, but in Germany at least, it was not yet considered the one and only gold standard it is today.

### **Some reflections on the phase of founding EAERE**

The dissatisfaction about poor information and networking among European ERE scholars grew in the 1980s. Many of us considered the US based AERE as an example worth following in Europe. Finally, senior professionals, notably Karl-Göran Mäler, David Pearce and Horst Siebert convinced Henk Folmer, a junior scholar at the time, to take on the job of working towards a European association. Recruiting fellow campaigners and members turned out to be quite easy, since the widespread consensus was that such an association would be necessary and highly beneficial for an effective development of the field. Nevertheless, getting it started required leadership with determination, long-term efforts, and organizational skills. Henk was the right person at the right time to cope with that challenge. In retrospect, he deserves credit for removing obstacles and keeping course over several years of launching EAERE. Enthusiasm and devotion are important but need to be supplemented with resources to make progress. Henk succeeded to solicit financial support for meetings notably from the European Commission (Jos Delbeke) and the Italian Fondazione Enrico Eni Mattei (Domenico Siniscalco).

In 1989, I became a member of Henk's multinational team and was involved in the preparation of the first EAERE conferences. The very first and famous Venice conference in 1990 of the still informal association was the perfect kick-start of EAERE with a perfect organization by Ignazio Musu and his team. I do underline and reemphasize some observations

made on the occasion of EAERE's 20<sup>th</sup> anniversary. The Venice conference "was a wonderful event [that] gave us participants the opportunity to spend time together, discussing issues that were close to our hearts" (Karl-Göran Mäler). The "family feeling and social activities" were and still are an important characteristic of EAERE (Aart de Zeeuw) (although the number of participants almost quadrupled). From the beginning, EAERE encouraged multicultural collaboration and was a place, "where friendships are created and renewed" (Anastasios Xepapadeas).

It may be interesting for younger scholars who are socialized in the digital age to learn about the difficulties of organizing a conference in the early 1990s, a time of digital transition. To submit a paper, you had to send three paper copies by snail mail. These copies were then sent out for screening and hopefully returned in time. After that, the program committee convened physically and made decisions on acceptance and on forming sessions. I remember such a meeting of the program committee for the conference in Stockholm (1991). First we made decisions on acceptance, then we piled up all accepted papers on one table and finally spread them out on several other empty tables in the room in an effort to form small piles of four papers that make reasonable sessions. After we had finished that job, we were physically exhausted. I admit that our approach may not have been the most professional, even at that time, but moving and handling paper copies was definitively more difficult and more time consuming than today's online procedures are.

EAERE clearly needed rules for orderly decision making. Following the usual procedure for academic associations, we set EAERE up as a non-profit association with tax-exemption status and a legal seat in a European country. Henk and I produced a draft of the statutes for EAERE, taking as an example the statutes of the European Economic Association that was founded a few years earlier. After the approval of the statutes by the general assembly in Stockholm, the first president and the council members were elected, and I volunteered to establish the legal seat of

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EAERE at the court in Siegen, Germany, in 1992. Unfortunately, we underestimated how complicated (for economists) the German legal provisions were. First, I had to translate the statutes and all correspondence, including the annual minutes of the General Assembly, into German. Second the officer in charge was reluctant to accept the term 'European' in the title of EAERE, until I finally convinced him that EAERE was truly European and was growing. Third, the procedure of registering the president and council members was awkward. Every newly elected person needed to have his or her identity officially confirmed, which required them to go to German embassies or consulates (to get these certificates for free).

The growth in membership required improving professionalism. So EAERE got an institutionalized secretariat in Venice (FEEM) and moved to Italy, where the legal requirements were much less demanding. What seemed to be a simple move for juristic laymen turned out to be almost impossible. Obviously, we had to dissolve EAERE as an association under German law, but we failed twice to obtain the qualified majority of votes even though all members *attending* the General Assembly voted for the move. You will hardly believe how we finally succeeded. We moved all assets to the 'new Italian association' (by orderly decision making) and then all members followed the call to leave the 'German association' and to simultaneously become members in the new 'Italian association'. Thus, the 'German association' had neither assets nor members anymore, and then the officer in charge was willing to deregister the 'German association' (1996).

#### Endnote

<sup>1</sup> Jedem Anfang wohnt ein Zauber inne  
(Hermann Hesse)

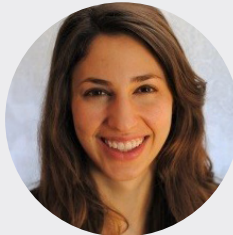
# Exploring willingness to delay charging by electric vehicle owners

Ricardo A. Daziano<sup>1</sup>, Briana Amoroso<sup>2</sup>, and Charleen Heidt<sup>3</sup>

<sup>1</sup> Cornell University, USA, <sup>2</sup> Taitem Engineering, USA, <sup>3</sup> NYSEG, USA



**Ricardo A. Daziano**, choice modeler, holds a PhD in Economics from Université Laval and is an associate professor of Civil and Environmental Engineering and of Systems Engineering at Cornell University. He is a fellow of the Cornell Atkinson Center for Sustainability. His work focuses on estimation of microeconomic choice models, applied to better understand the interplay of consumer behavior with engineering, investment, and policy choices for energy-efficient technologies. In 2013, he received an NSF CAREER award.



**Briana Amoroso** holds an MS in Sustainable Engineering from Rochester Institute of Technology. She is the Project Manager of New York State Gas and Electric Corp's OptimizEV pilot program. Previously, Briana was a project lead and team member of a variety of New York Reforming the Energy Vision pilot projects, including the development and launch of Green Button Connect, an award-winning low- and moderate-income program, and an online product and services marketplace.



**Charleen Heidt** holds an MBA with an emphasis on Marketing Research and Services Marketing from the Smeal College of Business and has over 35 years of practical experience in marketing research and strategic planning. She is presently the Community Outreach Coordinator for NYSEG/AVANGRID's Energy Smart Community (ESC). In this position, she oversees the marketing and research surrounding the ESC and helped launch the first offering within the pilot project YES Home Solutions, which later transitioned into NYSEG's Smart Solutions, as well as OptimizEV.

Electrification of vehicles is becoming one of the main avenues for decarbonization of the transportation market. Even though there are clear environmental benefits of renewable-based electromobility, large-scale charging from high penetration of electric vehicles (EVs) will require optimal scheduling of when electricity is delivered to vehicles (Bitar and Yunjian, 2017; Clement-Nyns et al., 2010). Cornell University researchers are working with NYSEG, the electricity and gas provider of upstate New York, in the implementation

of pilots to optimize integration of electric vehicles with the energy grid to reduce load variance and extreme demand peaks.

Coordinating EVs to charge at times when fewer people require electricity can effectively prevent stress on the power grid by reducing peak loads. An illustration of the flattened load profile that is expected from coordinated charging is shown in Figure 1. Smart EV charging can improve reliability of the power system as well as reduce system costs and emissions. From the demand side

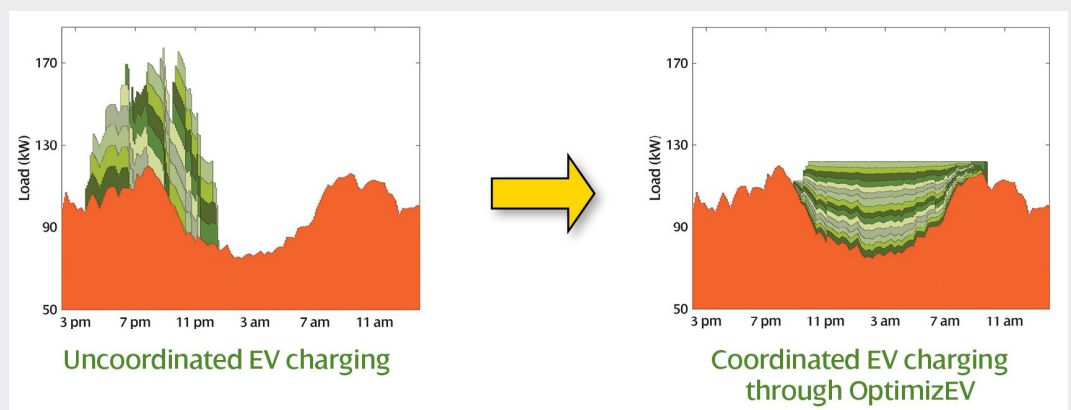


Figure 1. From uncoordinated peak load (left) to a coordinated, valley-filling load profile.

Source: [www.avanewsblog.com/blog/optimizEV](http://www.avanewsblog.com/blog/optimizEV)

of coordinated EV charging, residential customers would need to be willing both to delay charging their vehicles and to accept less than a 100% target for battery charge.

OptimizEV is a pilot program NYSEG is running within the Energy Smart Community of Tompkins County in upstate New York to precisely analyze residential optimal scheduling of the charging of electric vehicles. With a population of 101,564 (2010 US Census), Tompkins County comprises the college town of Ithaca, is home to Cornell University, and is now the first Energy Smart Community (ESC) in New York. The ESC project is a response to, first, the comprehensive energy strategy for New York Reforming the Energy Vision (REV), which mandates that 50% of New York's energy be generated by renewable sources by 2030, and second to the Energy Roadmap for Tompkins

performance of the scheduling algorithm in its interaction with the grid. A further goal is to understand customer charging preferences and the optimal incentives to ensure that customers accept charging flexibility. The OptimizEV pilot will ultimately help inform the design of smart residential EV charging programs across New York State. OptimizEV was developed in a partnership among Cornell University, NYSEG, Kitu Systems, and Taitem Engineering.

Before the start of the OptimizEV pilot, we led an online survey to study charging preferences by residential customers that either own or are leasing an EV. Another goal of the survey was to inform design of the user interface of the mobile app to communicate with the OptimizEV smart chargers. Respondents to the survey (N=462) either own (69%) or lease (27%) mostly plug-in hybrids (PHEVs), with

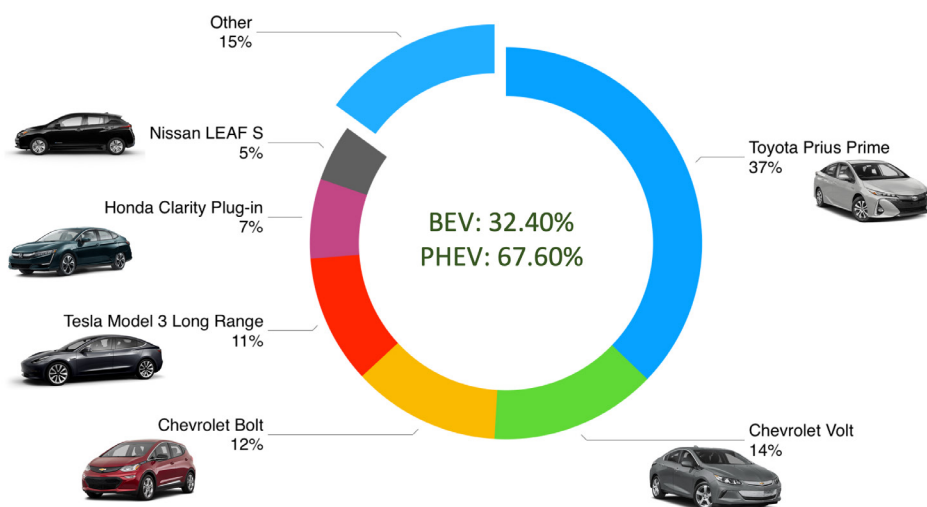


Figure 2. Electric vehicle ownership in the sample of respondents.

County, which aims at an 80% greenhouse gas reduction from 2008 levels by 2050.

Following an algorithm developed by Cornell researchers Eilyan Bitar and Polina Alexeenko, OptimizEV: 1) determines exactly when to charge an EV within both a timeframe and target charge specified by the customer, 2) offers a discount based on how long an EV is left plugged in, and 3) ensures the EV is ready to go when needed. 35 households in Tompkins County will engage in the pilot for a year. Data collected over this period will be used to test per-

pure battery electric vehicles (BEVs) representing around one third of the sample (Fig. 2). Of the 78% of respondents who typically leave their EVs plugged in until it is fully charged, 60% use a Level 1 charger at home. Other characteristics of the sample include: 55% have a graduate or professional degree; 90% live in a detached, single family home; 24% have onsite solar at home; 66% are employed full time; and 24% are retired.

Using a **choice experiment** in the survey to elicit customer preferences, we are cur-



rently using econometric choice models to analyze customer response to residential EV charging and deadline scheduling. The choice experiment was presented to respondents as the electricity provider offering an EV charging program reproducing the characteristics of the OptimizEV pilot in terms of **emission reductions** per session, **hours of control yielded to utility** (to decide when to charge), and **discount per charging session** at home (when willing to delay EV charging). Even though participation in the OptimizEV pilot is free, the experiment considered a **payment for the coordinated EV charging service**

but the negative effect can be offset by the two benefits above (discount and environmental impact). In fact, choice models can be used to derive estimates of customers' maximum willingness to pay (WTP) for the features of experimental bundles. These WTP metrics reflect monetary valuation coming from the stated choices and the revealed preference mapping. From conditional logit estimates, assuming a homogenous sample, we derived a negative willingness to pay of \$2.40 for each hour increase in the timeframe for which the customer is giving up control of charging of their EV (cf. Richter and


	Bundle A	Bundle B	Bundle C
Brand of charging system			
Emission reductions per session	35 <small>pounds of CO<sub>2</sub></small>	35 <small>pounds of CO<sub>2</sub></small>	50 <small>pounds of CO<sub>2</sub></small>
Hours of control yielded to utility	4 <small>hours</small>	8 <small>hours</small>	8 <small>hours</small>
Payment for service (annual fee)	\$90 <small>per year</small>	\$50 <small>per year</small>	\$25 <small>per year</small>
Discount per charging session at home	5% <small>per session (\$0.98/month)</small>	10% <small>per session (\$1.95/month)</small>	2% <small>per session (\$0.39/month)</small>

Figure 3. Sample of choice card.

(as an annual fee) with included installation of a free Level 2 charger with technical capability to coordinate charging. Figure 3 shows a choice card sample.

Preliminary policy recommendations from the choice analysis include:

- ① Display the discount as a percentage: positive valuation of percent savings is greater than those of actual dollars
- ② Convey information about environmental benefits: EV owners/lessees are environmentally aware and desire to know the pounds of GHG emissions being saved when EV is delayed. In fact, respondents stated to prefer to be informed in pounds of emissions rather than simplified equivalents such as trees being saved.

A key outcome is that allowing the utility to delay charging is negatively perceived,

Pollitt, 2018). This negative estimate can be seen as an expected rebate in the annual fee that the customer accepts in exchange for their willingness to delay charging.

Because of heterogeneity in preferences it is likely that willingness to pay varies by customer. A useful approach to designing programs and communication strategies is to analyze demand and welfare metrics by customer segment. The Smart Energy Consumer Collaborative (SECC) in the US has developed an energy customer segmentation algorithm that utilities use to better understand their markets. SECC is a nonprofit organization with a declared mission to “serve as a trusted source of information on consumers’ views of grid modernization, energy delivery and usage, and to help consumers understand the benefits of smart energy.” The 2019 SECC Consumer Pulse and Market

Segmentation report has identified four new segments of energy customers. The SECC segments are based not only on attitudes and behaviors toward the environment, energy efficiency, and technology, but also on interest and actual actions taken in energy saving technology. The SECC customer segmentation algorithm was used in this project, leading to the following shares:

- ① **Green Innovators** (strongly value sustainability): 32%
- ② **Tech-savvy Protégés** (receptive to saving energy): 25%
- ③ **Movable Middle** (lack interest in technology): 15%
- ④ **Energy Indifferent** (reject environmental concerns): 28%

charging exhibit the opposite direction: **green innovators** would request a rebate of \$1.07 per each additional hour of control yielded, whereas the **energy indifferent** segment requests a rebate of \$3.72. In addition, the models provide estimates of the expected changes in the likelihood of joining a coordinated EV charging program. Since discounts and GHG reductions have associated positive WTP measures, incremental changes in these program characteristics increase the likelihood to join. In terms of socio-demographics, millennials are almost 3 times more likely to join than Baby Boomers, and almost twice as likely as Generation Xers.

In sum, from preliminary analysis of the survey data:

### Choice model with SECC segments

• All marginal valuations (willingness to pay per unit increase)

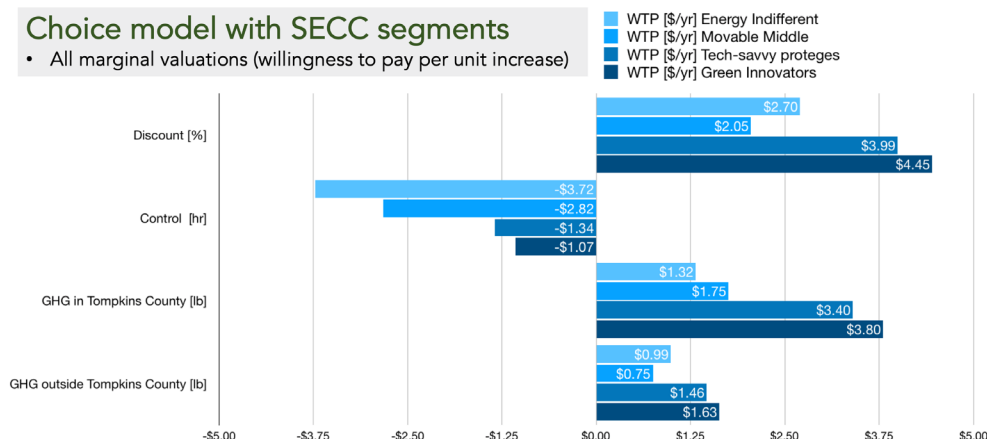


Figure 4. Willingness to pay estimates by SECC segment.

By integrating the SECC segmentation with the choice models, it was possible to derive WTP estimates for each of the four energy customer segments (Fig. 4).

As shown above, the analysis led to marginal WTP measures with statistically significant variation across segments. Marginal WTP measures are interpreted for each incremental change in a feature of the program. For example, **green innovators** are willing to pay an average of \$4.45 per year for each one-percent increase in the discount offered, whereas those that are **energy indifferent** are willing to pay only \$2.70 for the same improvement in the discount. Resulting compensations for each hour of giving up control of EV

① **Green innovators** and **tech-savvy protégés** value discounts and emission savings and are not really concerned about yielding control of charging to realize savings

② The **movable middle** is really concerned about yielding control, but can be swayed to join a program such as OptimizEV when informed of GHG reductions

③ **Energy indifferents** desire to keep full control of their charging, but are open to monetary discounts

④ There is a clear generational divide in how valuable coordinated EV charging

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is perceived to be, with younger generations being much more receptive

In conclusion, a new energy landscape emerging with the development of technology that both optimizes power systems in real time and addresses climate change, and customer engagement is essential to fully take advantage of technological change. Furthermore, successful design and deployment of energy-saving programs and services crucially depends on an accurate characterization of customer preferences. This project will determine the required incentives to persuade residential customers to delay charging and to accept a lower charge target for their electric vehicles. Preliminary results from survey data before the roll-out of the actual pilot have provided evidence that both monetary discounts in delivery charges and emission savings from delaying charging to off-peak hours can offset disutility of giving up control of when charging takes place. Future work will include the consideration of more flexible representations of unobserved preference heterogeneity for modeling the survey data, as well as modeling revealed preferences coming from those 35 households involved in the actual pilot.

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# Confidence in climate change knowledge

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**Helen Fischer** is a postdoctoral researcher at the Complex Adaptive Systems Group at the Stockholm Resilience Centre, Sweden, funded through the German Research Foundation (DFG). Her research interests lie in public understanding of complex and dynamic problems, particularly with respect to climate change, and in public understanding of science. She holds a PhD in cognitive psychology from Heidelberg University.



**Dorothee Amelung**, a researcher with a background in psychology and an interest in sustainable behavior change, has worked on a range of topics in the areas of climate change and health, including public understanding of climate change, climate-friendly behavior, and reactions to Climate Engineering technologies. Dorothee has held a post doc position at University of Surrey, UK, and currently holds a post doc position at Heidelberg University. She holds a PhD from Heidelberg University.

**Nadia Said** is a Postdoc at the Interdisciplinary Center for Scientific Computing (IWR), Heidelberg University. The main focus of her interdisciplinary research is the application of mathematical methods to psychological topics such as belief polarization, understanding of climate change, and the understanding of non-linear processes. She tackles those questions by applying a variety of methods like cognitive modeling, agent-based modeling, and mathematical optimization methods. NSF CAREER award.

Uncertainty is often used as an argument to delay meaningful climate action. Such arguments do not remain theoretical but affect tangible choices, for example if US farmers are reluctant to adopt changes in agricultural practice due to perceived uncertainty in what we know about climate change. Uncertainty in this context can denote two things: the inherent scientific uncertainty over a correct description of reality such as the climate sensitivity parameter or the probability of certain climate impact scenarios; and it can denote a second type of (psychological) uncertainty: The uncertainty citizens experience when assessing the state of their own knowledge. Do citizens know what they know, and more crucially, do they know what they don't know? Can citizens be sure to base their decisions on accurate knowledge? This so-called meta-knowledge or confidence in knowledge affects how knowledge is put into practice. **Evidence points towards the importance of meta-knowledge for decisions in all areas of high uncertainty, including business, politics or medicine.** For example, doctors may base their treat-

ment decision on a premature diagnosis they are too confident in, or they may unnecessarily delay important treatment due to unnecessarily low confidence in their diagnosis. Similarly, a lack of confidence in one's own climate knowledge can unnecessarily hamper action, and overly high confidence in inaccurate knowledge can result in biased decisions.

Research so far has focused on what the public knows about climate change. However, if one is interested in why climate knowledge often is not put into practice, one needs to consider whether members of the public can even make use of their knowledge. In an ideal world, we would not only wish for a well-informed public, but for a public that is also well-calibrated with respect to their meta-knowledge. In other words, a public that knows the scientific evidence on climate change and has sufficient confidence in this knowledge to actually use it.

**Considering the importance of meta-knowledge as a potential explanation for the knowledge-ac-**

**tion gap, we therefore wondered whether members of the (German) public know what they know and don't know about climate change.**

To address this question we (Fischer, Amelung & Said, 2019) asked a national sample of German citizens to verify eight statements about the causes of climate change, its current state, and its consequences. The eight statements were:

- The global average temperature in the air has increased approx. 3.1 °C in the past 100 years. (False)
- The 1990s was the warmest decade during the past 100 years. (False)
- The global change in temperature in the past 100 years is the largest during the past 1,000 years. (True)
- Climate change is mainly caused by a natural variation in sunbeam and volcanic eruption. (False)
- Carbon dioxide concentration in the atmosphere has increased more than 30% during the past 250 years. (True)
- The increase of greenhouse gases is mainly caused by human activities. (True)
- The blanket of snow in the Northern Hemisphere has decreased approximately 10% since the 1960s. (True)
- An increasing amount of greenhouse gases increases the risk of more UV-radiation and therefore a larger risk of skin cancer. (False)

For each of these statements, citizens indicated whether it was true or false. Importantly, to assess not only knowledge, but also meta-knowledge, citizens indicated, after each verification: "How certain are you that your answer is correct?"

Are German citizens' confidence judgments trustworthy indicators of their actual climate change knowledge? For true statements this appeared to be the case: Even though there were statements for which citizens were mildly under- or over-confident, our results showed that citizens were well-calibrated overall. That is, for true statements, citizens could reliably indicate what they know about climate change

For the false statements, however, the results revealed a radically different picture: citizens appeared to have no insight into their lack of knowledge. Specifically, citizens vastly overestimated their ability to recognize false statements as false.

To put these results into context, we compared meta-knowledge of climate change in the German population with (1) meta-knowledge in general science (e.g., "Lasers work by focusing sound waves" or "Antibiotics kill viruses as well as bacteria") in another national German sample; and with (2) meta-knowledge of climate change in a sample of over two hundred scientists working in climate science.

These comparative results showed that German citizens' confidence was particularly poorly aligned with the accuracy of their climate change knowledge compared to both (1) their knowledge of general science, and (2) compared to scientists. Importantly, these differences were not due to differences in knowledge, but held also when controlling for knowledge. **Moreover, even when compared to their own climate change knowledge, German citizens' confidence was less calibrated than it could be, showing that citizens were unnecessarily confused about their own knowledge of climate change.**

### Relevance and Implications

We found a lack of insight into climate change knowledge in the German population which is relevant for at least three reasons.

First, given prior research demonstrating the importance of well-calibrated confidence for optimal decision-making (Hadar & Sood, 2014; Meyer, Payne, Meeks, Rao, & Singh, 2013), our results are worrying. Citizens could hardly tell when statements about climate change were false, and this was the case even when they were sure they were right. This is all the more troublesome given that not only own confidence, but also other's confidence can be decision-relevant: All else being equal, citizens tend to rely more on more confident informants (Tenney, Spellman, & MacCoun, 2008). **Our results hence suggest that citizens**

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may be led astray both by their own, as well as others' unwarranted confidence in the accuracy of false statements.

Second, misunderstandings and outright misinformation campaigns dilute factual climate change information, thus potentially affecting not only what the public knows about climate change, but, more crucially, the public's trust in what they know. **Even though we can only speculate about the specific reasons for lacking insight into climate change knowledge, our results point towards the potential relevance of clear communication of science** to counteract the often-times overly simplistic communication of false climate change information. Given the inevitable uncertainty present in climate science per se, citizens should be certain of those facts for which a high scientific consensus exists.

Third, the "Action for Climate Empowerment" (ACE) by the UNFCCC identifies six priority areas—education, training, public awareness, public access to information, public participation, and international cooperation—that jointly allow addressing the complex problem of climate change by empowering society to engage in climate action (Pass, 2016). **Particularly for the areas of public awareness and education, our results shed light on what society may additionally need even when knowledge is high: Appropriate confidence in knowledge.** Hence, successful education and public awareness programmes should aim at conveying not only knowledge, but also confidence in knowledge.

To conclude, we found that the German population is unnecessarily confused about their climate change knowledge. This result points towards meta-knowledge as a potential explanation for the knowledge-action gap when it comes to raising sufficient public climate change action.

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# Marty Weitzman, In Memoriam

**Gernot Wagner**

*New York University, USA*

*Gernot Wagner teaches at NYU and co-authored [Climate Shock](#) with Martin Weitzman, among others a [Top 15 McKinsey Financial Times Business Book of the Year 2015](#).*

There's [Weitzman \(1979\)](#) that included both brilliant insights on optimal search theory and a brilliant reference to Greek mythology in form of "Pandora's Problem." There's [Weitzman \(1976\)](#) and [Weitzman \(1998\)](#), spanning his work on green accounting and welfare. There's [Weitzman \(1992\)](#) and [Weitzman \(1993\)](#), introducing set theory and economic thinking into species conservation. There's [Weitzman \(2007a\)](#), a brilliant new take on the equity risk premium puzzle that appears to have eluded financial economists for decades. That insight, in turn, led to [Weitzman \(2009\)](#) and [Weitzman \(2011\)](#) and [Weitzman \(2012a\)](#), which introduce fat tails into the climate debate, something that had eluded climate economists. There's [Weitzman \(2001\)](#), [Weitzman \(2010\)](#), and [Weitzman \(2012b\)](#), sparking hundreds of papers and epic debates on how to think about discounting the distant future. There's [Weitzman \(1984\)](#), followed by [Weitzman \(1985a\)](#) and [Weitzman \(1985b\)](#) and [Weitzman \(1985c\)](#), introducing the *Share Economy*, on how and why workers should partake in profit sharing, an idea a *New York Times* editorial<sup>1</sup> called the "best idea since Keynes." Then there's [Weitzman \(1974\)](#), *Prices vs. Quantities*, the brilliant analysis of when to price versus when to limit emissions that launched the field of instrument choice, sparked policy debates the world over, and launched many an environmental economist's career. There are dozens more such papers, many offering brilliant insights to important problems, often using complex math to solve seemingly intractable problems, offering conclusions typically summarized in a simple equation or cleverly chosen *bon mot*.

Then there's Marty the teacher, person, and mensch. The kid from the Lower East Side who never did lose his New York accent. The person who, as a young professor in Cambridge, MA, bought a small, barren island in a marsh in

Gloucester, MA, to build a refuge from academic life, a place where he taught himself Bayesian statistics in his sixties to write that equity risk premium puzzle paper, and where he went on a daily swim well into his seventies.

Weitzman was an academic's academic, a theoretician's theorist—someone who eschewed the trends in his discipline toward churning out ever more empirical analyses with larger and larger data sets and more and more coauthors. He appreciated and admired the efforts of those who did dive into thorny empirical questions with increasingly powerful computers. His preferred tools: a No. 2 pencil, a legal pad, and a hard wooden chair.

His study at the home he shared with his wife, Jennifer Bäverstam Weitzman, in Waban, MA, included just that. The laptop served mainly as a repository of papers and as a communications device. While Jennifer gave piano lessons in the living room, he focused on his next idea, playing his recorder whenever he felt his mind wander to refocus at the problem at hand.

It was this relentless focus on getting every model, every equation, every sentence just so that yielded some of the most consequential papers in all of environmental economics, his chosen field, and economics more broadly. [Bill Nordhaus](#) was right to say that “Marty Weitzman was the pre-eminent environmental economist of the modern era, which is to say of all times.”<sup>2</sup>

*Prices vs. Quantities* began as a study of the Soviet economy, whether price or quantity controls yielded better results. The resulting paper attests to Weitzman's intellectual nimbleness. His first submission was met with a rejection, and a reviewer's comment that he might want to tackle a different set of questions, emerging in the early 1970s: whether to price or limit pollution. He recast the paper, his most cited work to date, and refocused a good part of his subsequent work on environmental problems and their solution.

While Weitzman the scholar loved to take on big intellectual problems, it was Marty the person who cared deeply about the world and how to improve society's lot in it. Unapologetically focused on human well-being, he wrote some of the foundational papers on whether and how to account for natural resources and environmental quality, what has become known as “green accounting” or “green GDP.” Never shy to tackle difficult problems, he focused his final two decades almost exclusively on what he called a “wicked” problem: climate change. His focus: what science does not—perhaps cannot—know.

His work shows how it is precisely these unknowns and potentially unknowables that should lead to more of an emphasis on climate action now. Weitzman's papers on discounting the far-distant future argue how uncertainty around the right rate should lead to declining discount rates over time: the farther out one goes, the lower the rate. His work on climate risks and uncertainties argues how it is precisely this tail risk that dwarfs all else. He termed the insight the “[dismal theorem](#)”—not because he liked the term, but because it brilliantly summarized the conclusion.<sup>3</sup>

Weitzman had epic debates with some of his peers. With Christian Gollier, he debated the right way to think about the term structure of discount rates, culminating in one of his rare coauthored papers, [Gollier and Weitzman \(2010\)](#), once it became clear that both were looking at the same question from two different sides. With Bob Pindyck and Bill Nordhaus, he debated the implications of tail uncertainty and how to make sense of climate risk. In one of his most consequential policy-focused papers, he argued how the *Stern Review on the Economics of Climate Change* was “[right for the wrong reasons](#).”<sup>4</sup>

Weitzman the scholar will be remembered for many towering intellectual achievements. Marty the teacher, colleague, and friend will live on in our hearts, as generous with his time and devoted to making life better for all. Marty Weitz-



man the person would have loved nothing more than for his insights to rattle the status quo and to spark debates that will undoubtedly continue for years to come.

## Endnotes

<sup>1</sup> [www.nytimes.com/1985/03/28/opinion/best-idea-since-keynes-these-are-best-economic-times-for-most-americans-but-what.html](http://www.nytimes.com/1985/03/28/opinion/best-idea-since-keynes-these-are-best-economic-times-for-most-americans-but-what.html)

<sup>2</sup> [www.nytimes.com/2019/09/04/business/energy-environment/martin-weitzman-dead.html](http://www.nytimes.com/2019/09/04/business/energy-environment/martin-weitzman-dead.html)

<sup>3</sup> See Weitzman, 2009

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The European Association of Environmental and Resource Economists (EAERE) is an international scientific association which aims are:

- \_to contribute to the development and application of environmental and resource economics as a science in Europe;
- \_to encourage and improve communication between teachers, researchers and students in environmental and resource economics in different European countries;
- \_to develop and encourage the cooperation between university level teaching institutions and research institutions in Europe.

Founded in 1990, EAERE has approximately 1200 members in over 60 countries from Europe and beyond, from academic institutions, the public sector, and the private industry. Interests span from traditional economics, agricultural economics, forestry, and natural resource economics.

Membership is open to individuals who by their profession, training and/or function are involved in environmental and resource economics as a science, and to institutions which operate in fields connected with the aims of the Association.

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